14 February 1964

CONTACT DUPLICATING AND RESEAU PRINTER

1. SCOPE

1.1 This purchase description establishes the requirements for a high speed, maximum resolution, minimum distortion step and repeat duplicating and reseau printer. It is intended that the equipment be suitable for full time production use and it is not to be considered an experimental or prototype model.

2. APPLICABLE DOCUMENTS

The following documents, of the issue in effect on the date of invitation for bids, are to be used by the Contractor as guides in the design and fabrication of the contact duplicating reseau printer.

SPECIFICATIONS:

Military

MIL-E-4158B - Electronic Equipment Ground: General Requirements for

MIL-S-6872 - Soldering Process, General Specification for

MIL-S-11748 - Suppression Requirements for Electrical and Electronic Equipment (Except Internal Combustion Engine-Driven Equipment)

STANDARDS:

Military

MIL-STD-15 - Electrical and Electronic Symbols

MIL-STD-16 - Electrical and Electronic Reference Designations

MIL-STD-122 - Color Code for Chassis Wiring for Electronic Equipment

MIL-STD-129 - Marking for Shipment and Storage

3. REQUIREMENTS

3.1 Description - The contact duplicating reseau printer shall be of a sturdy compact design capable of satisfactory duplication of films from 70 mm to 9 1/2" wide with format lengths up to 30". In addition to its primary function as a duplicating printer, the equipment shall also have the capability of accurately exposing a reseau grid onto the duplicate

(output) film at the discretion of the operator. The printer shall be designed to prevent damage to the original film input to the maximum extent possible. It shall be capable of operating in an automatic mode, including automatic exposure control (without reseau) and in a semiautomatic mode (with or without reseau). The printer shall provide the capability for printing either through the base of the input film, or, emulsion to emulsion.

3.2 Design Analysis and Plan

3.2.1 Analysis - The Contractor shall prepare a design analysis of the printer and submit it to the Contracting Officer for approval. The analysis shall present the characteristics of the printer and its component elements which are required to meet the performance specifications herein. The analysis shall indicate any areas where development effort must be concentrated in order to meet these requirements. It shall also contain an error analysis of the printer showing where errors originate and approximately how much error can be tolerated from each source. The design analysis shall disclose any areas requiring detailed attention.

3.2.2 Plan - After approval of the design analysis, the Contractor shall present a design plan to the Contracting Officer for approval. The design plan shall include layout drawings which illustrate the proposed design in sufficient detail to permit evaluation of the proposed approaches from the standpoint of engineering feasibility methods and materials of construction. Operating space, electrical power, ventilation, and cooling requirements shall be submitted as part of the design plan. The Contractor shall not begin fabrication of the printer until the design plan has received the written approval of the Contracting Officer. Approval of the design plan shall not be construed as relieving the Contractor from any of the technical requirements specified herein.

3.3 Film Input - The printer shall accommodate original and duplicating films with nominal base thicknesses from 2.0 to 7.0 mils having nominal widths of 70 mm to 9 1/2" and lengths up to 1,000 ft. Provision shall be made for cutting the duplicating film to permit removal of partially exposed film.

3.4 Reseau - The printer shall be equipped with a continuous line reseau having lines spaced at 1 cm intervals ± .010 mm. The reseau shall have a format of 30 by 9 1/2 inches. The intersections of the lines shall

be calibrated to a standard error of two (2) microns relative to the center of the reseau. For identification purposes every other line in one direction shall be numbered and every other line in the perpendicular direction shall be lettered. The numbers and letters shall be legible on the output film without magnification and shall not exceed .04" in size.

3.4.1 Material - The glass stage plate, if used, and the glass reseau plate shall have sufficient thickness to remain flat over the entire printing area consistent with the requirements of this purchase description. The glass shall be of high quality with a high degree of resistance to surface wear, free from scratches, bubbles, or striae. Coatings shall be provided as required to protect the grid lines against damage from normal storage, handling and cleaning.

3.4.2 Reseau Lines - The lines provided on the reseau grid plate shall possess characteristics such that the line images will register as distinct legible lines on the output film having widths between twelve (12) and fifteen (15) microns when projected through a film base of seven (7) mils thickness and a density range of .2 to 3.2.

3.4.3 Reseau Alignment - Means shall be provided to facilitate precise alignment of the fiducials on the film being duplicated with the reseau, without exposing or fogging the output film through the use of auxiliary alignment equipment. This alignment must be precisely maintained by the printer during exposure. The auxiliary alignment equipment shall provide a means for projecting the fiducial and reseau images to facilitate viewing the film at a four (4) diameter enlargement with a field of view of at least three (3) inches having a recticle at least two (2) inches in length. The viewer shall be provided with a mechanism capable of simultaneously punching a hole and a slot through the film at a fixed distance outside the format of the film when the recticle is aligned with the fiducials of the film and one of the reseau lines passing through a selected fiducial mark. The total error resulting from alignment, punching, and placement in the printer shall not exceed five (5) microns.

3.5 Printing Format - The printing format shall be continuously variable in width from 70 mm to 9 1/2" and in lengths up to 30". Suitable masking devices shall be provided, if required, for printing format sizes less than the maximum.

3.6 Film Transport - Independent motorized film transport systems shall be provided for the original and duplicate films. Each shall be capable of automatically transporting a metered length of film across the printing area upon command of the operator and each also shall provide both rapid and slow film transport under direct control of the operator. The printer shall be capable of automatically repeating selected frames at the descretion of the operator. The number of repeated frames shall

be any quantity up to ten. The length of film to be transported in the metered mode of operation shall be controllable by the operator. Provision also shall be made for synchronizing the two film transport systems at the perogative of the operator. Provision shall be made to prevent damage to the output film emulsion by the accumulation of static electricity resulting from the transport of the two films either simultaneously or independently.

3.7 Film Contact - Contact between the reseau or stage plate and films during exposure shall be sufficient to insure imagery transfer with no distortion and with minimum loss of resolution. Provisions shall be made to prevent contact markings or Newton rings from affecting the photographic quality of the output.

3.8 Exposure Light - The exposure light shall provide for the transfer of images from the negative to the output film with an absolute minimum of distortion and resolution loss. The light source and exposure control system shall be designed for compatibility with Kodak Fine Grain Aerial Duplicating Film, Type 8430 (formerly SO-278), through a density range of 0.2 to 3.2.

3.9 Exposure Control - Automatic and manual means shall be provided for, at the discretion of the operator, the scanning of each frame of the negative with a mobile photocell probe or other device suitable for measuring the intensity of illumination being transmitted through the negative to permit control of the exposure prior to starting each exposure sweep.

3.10 Operating Modes

3.10.1 Automatic Mode - The instrument shall be capable of continuous automatic operation when a reseau is not being exposed onto the duplicating film. In this mode the film transport, exposure light system, film flattening system, etc., shall be interlocked so that a completely automatic printing operation may be carried out until halted by the operator or until the film supply is depleted. In the latter case provision shall be made for automatically turning off the instrument.

3.10.2 Semiautomatic Mode - The instrument shall be capable of semiautomatic operation. In this mode, provisions shall be provided for the operator to accurately control the alignment of the reseau. He will then activate the film flattening system and the exposure light system to make the exposure.

3.11 Resolution - The resolution produced by the printer shall be not less than 300 lines/mm on Kodak SO-105 film employing a high contrast (1000:1) resolution target. The measurements of the resolution shall be accomplished by means of a microdensitometer.

3.12 Printing Speed - The printer shall be capable of duplicating at least six, 9 x 30 inch exposures per minute, exclusive of the time required for the operator to align the film fiducials with the reseau.

3.13 Rigidity and Alignment - All parts of the printer shall be of sufficient strength and rigidity to maintain smooth operation and proper alignment.

3.14 Reliability - The printer shall provide the maximum possible reliability consistent with the state-of-the-art.

3.15 Service Conditions - The printer shall be suitable for operation in a "white room" area and when in operation shall not appreciably contaminate or degrade the "white room" conditions specified in paragraph 3.15.1. Maximum consideration shall be given to preventing the creation or accumulation of dust and dirt and to permitting ease of cleaning. In the event that the operation of any part of the printer involves unavoidable generation of dust or dirt, that portion shall be inclosed and provided with an exhaust outlet suitable for connection to an exhaust system.

3.15.1 White Room Conditions

(a) Temperature - 70° ± .5° F

(b) Relative Humidity - 50% ± 0.5%

(c) Dust count, maxima -

485	particles/cu ft	5	micron	size
10	" "	"	"	
5	" "	10 to 15	micron	size

3.16 Human Engineering - Principles of human engineering shall be followed in the design and construction of the printer.

3.17 Corrosion - Resisting Materials - All materials shall be of corrosion-resistant material or shall be suitably treated to render them resistant to corrosion.

3.18 Radio Interference Suppression - The printer shall be equipped for the suppression of radio interference in accordance with specification MIL-S-11748.

3.19 Electrical Requirements - The printer shall be designed for operation from a 120-208 volt, 60 cycle, 3 phase, 4-wire power supply. A plate showing electrical data shall be securely affixed in a conspicuous place near the outlet of the main power supply cord. If frequency or voltage variations will damage the printer, adequate protective devices shall be provided to prevent this type of damage.

3.20 Operator's and Maintenance Manual - An operator's and maintenance manual (5 copies) shall be provided with each printer containing instructions for the operation of the printer and describing those operations or tasks necessary for normal maintenance and repair. Each operation to be performed by the operator or by the maintenance personnel shall be sufficiently described and illustrated in detail to enable such individuals to successfully accomplish in proper sequence the actions described. Wiring diagrams of the entire printer in sufficient detail for maintenance use shall be included.

3.21 Safety and Operational Protection - All rotating or reciprocating parts and parts subject to high temperatures that are of such nature or so located as to become a hazard to operating personnel, shall be insulated, fully inclosed or properly guarded. Limit switches shall be provided for all motions to prevent damage to the printer in the event of malfunction of any component or inattentiveness on the part of the operator.

3.22 Instruction Plates - The printer shall be equipped with instruction plates, including warnings and cautions suitably located, describing any special or important procedures to be followed in operating and servicing the printer.

4. QUALITY ASSURANCE PROVISIONS

4.1 Test Plan

A test plan shall be prepared and submitted to the Contracting Officer for approval. This test plan shall be in sufficient detail to explain the test methods and procedures to be used to determine conformance with the requirements of this purchase description.

4.2 Tests

Prior to delivery the printer shall be tested by the Contractor in accordance with the approved test plan, paragraph 4.1. The tests shall be conducted at the Contractor's plant by the Contractor, in the presence of Government Inspectors. Materials and equipment required for all tests shall be furnished by the Contractor. A detailed report of the test results shall be delivered with the printer.

4.3 Inspection

In addition to the tests performed by the Contractor, the printer shall be subject to inspection by Government Inspectors at the Contractor's plant and after delivery and assembly to determine conformance with the requirements of the purchase description. Preliminary acceptance and/or approval of materials or components during the course of construction shall in no case be construed as a guarantee of final acceptance of the printer.

5. PREPARATION FOR DELIVERY

5.1 Packing

Packing and crating shall be for domestic shipment.

5.2 Marking

Marking for shipment shall conform to Standard MIL-STD-129, except as may be modified by the Contracting Officer.

6. NOTES

6.1 Notes - When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility, nor any obligation whatsoever; and the fact the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use or sell any potential invention that may in any way be related thereto.